

An Integrated Sustainability Governance Framework for New Nuclear Projects: The JEK2 Case Study

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Abstract

The transition towards climate neutrality has significantly increased the importance of sustainability governance in the planning and implementation of large infrastructure investments. While the European Sustainability Reporting Standards (ESRS) establish a comprehensive framework for sustainability reporting, new nuclear projects require the integration of ESRS sustainability reporting with internationally recognised IAEA governance principles and the INPRO sustainability assessment methodology. Despite these complementary approaches, limited guidance exists on how these frameworks can be integrated into project governance during the early development phase.

This paper presents an integrated sustainability governance framework developed within GEN energija during the preparation of the JEK2 new nuclear project. Using a qualitative conceptual case study methodology, it examines how sustainability governance can be embedded into strategic project management through the integration of ESG strategy, sustainability metrics, responsible decision-making, ESRS reporting principles, IAEA management requirements and the INPRO sustainability methodology.

The proposed framework demonstrates that sustainability reporting is most valuable when treated as a strategic management instrument rather than a regulatory obligation — one that supports governance, transparency, organisational resilience and stakeholder confidence. The framework is applicable to new nuclear projects and potentially transferable to other complex infrastructure investments operating within highly regulated environments.

Keywords: sustainability governance, ESG, ESRS, IAEA, INPRO, JEK2

1

1.1 Introduction

1.2 Background

The growing urgency of climate change, energy security and sustainable development has fundamentally transformed the governance of large infrastructure projects. Organisations are increasingly expected to demonstrate not only technical excellence and economic viability but also responsible environmental, social and governance (ESG) performance throughout the entire project lifecycle. Sustainability has moved from a voluntary corporate initiative to a core component of strategic management.

Within the European Union, this shift has been reinforced by the Corporate Sustainability Reporting Directive (CSRD) and the European Sustainability Reporting Standards (ESRS). These regulations require organisations to disclose material sustainability impacts, risks and opportunities using a structured and comparable reporting framework. Crucially, ESRS introduces the principle of double materiality — requiring organisations to assess both the effects of sustainability issues on the organisation and the organisation's effects on society, the environment and the economy.

For organisations responsible for developing critical energy infrastructure, sustainability governance extends well beyond regulatory reporting. New nuclear power projects involve exceptionally long planning horizons, significant investment requirements, complex stakeholder environments and high public expectations regarding safety, transparency and accountability. Sustainability considerations must therefore be embedded into project governance from the earliest planning stages, not bolted on after key decisions have already been made.

1.3 Nuclear governance and sustainability

The nuclear industry has long operated within internationally recognised governance systems emphasising leadership, safety culture, continuous improvement and organisational responsibility. The International Atomic Energy Agency (IAEA) provides the principal internationally recognised governance principles, while INPRO — the International Project on Innovative Nuclear Reactors and Fuel Cycles — complements them with a structured methodology for assessing the long-term sustainability of nuclear energy systems across six dimensions: economics, infrastructure, environment, nuclear safety, waste management, and proliferation resistance.

1.4 A gap in integrated guidance

Existing literature provides extensive guidance on sustainability reporting, ESG governance and nuclear management systems individually. What is largely missing is practical guidance on how these frameworks can be combined into a coherent governance model during the development phase of a new nuclear project.

In practice, organisations frequently treat sustainability reporting separately from project governance, while nuclear management systems focus primarily on safety, quality and regulatory compliance. This fragmentation reduces the strategic value of sustainability information and limits its contribution to project decision-making. The development of the JEK2 project provides a direct opportunity to close this gap.

1.5 Research objective

The objective of this paper is to develop and present an Integrated Nuclear Sustainability Governance Framework (INSGF) for new nuclear projects, using the JEK2 project as a case study. The INSGF

combines ESRS sustainability reporting, IAEA governance principles and the INPRO sustainability assessment methodology into a single conceptual governance model.

1.6 Structure of the paper

Section 2 describes the research methodology and conceptual framework. Section 3 presents the integrated sustainability governance model and its application within the JEK2 project. Section 4 discusses the theoretical and practical implications of the proposed framework. The paper concludes by outlining its main contributions, limitations and recommendations for future research.

2 Methodology

2.1 Research design

This paper applies a qualitative conceptual case study approach to examine the integration of sustainability governance into the early development of a new nuclear power project. The research focuses on the JEK2 project developed within GEN energija and is concerned with the design of a governance framework rather than the evaluation of completed project outcomes.

The case study methodology was selected because the JEK2 project represents a distinctive organisational environment where sustainability governance is being incorporated into project planning before construction begins. This enables analysis of governance structures, decision-making processes and sustainability integration during the strategic planning phase — where the long-term principles of the project are established.

2.2 Theoretical framework

The framework draws on three internationally recognised systems — ESRS, IAEA and INPRO — each providing a complementary perspective on sustainability governance, organisational management and long-term sustainability assessment. Together, they form the theoretical foundation of the proposed integrated model.

2.3 Research materials

The conceptual framework was developed through the analysis and integration of multiple sources, including international standards, IAEA publications, ESRS requirements and GEN energija's internal governance documentation. The combination of international standards and practical organisational experience enabled the development of a framework that is both theoretically grounded and practically applicable.

2.4 Research process

The research proceeded in four phases. The first analysed ESRS governance requirements, with particular attention to governance disclosures, strategic sustainability integration and the double materiality concept. The second examined IAEA governance principles and the sustainability dimensions of INPRO, identifying common characteristics across both frameworks. The third phase synthesised these findings into a single conceptual governance framework aligned with GEN energija's sustainability governance structure. The fourth evaluated the practical applicability of the integrated framework by mapping its components to the sustainability management approach developed for the JEK2 project.

2.5 Proposed Integrated Sustainability Governance Framework

The outcome of the research is an integrated governance framework that positions sustainability as a strategic management function. The framework links three perspectives:

- ESRS — providing governance architecture, reporting requirements and double materiality assessment;
- IAEA — providing leadership principles, management systems and organisational governance;
- INPRO — providing long-term sustainability assessment for nuclear energy systems.

These three pillars converge within the project's governance system, where sustainability metrics, stakeholder engagement, risk management and strategic decision-making are integrated into a single management framework.

3 Results – Development of an Integrated Sustainability Governance Framework

The results demonstrate that sustainability governance within large nuclear infrastructure projects can be significantly strengthened by integrating European sustainability reporting requirements with internationally recognised nuclear governance principles. ESRS, IAEA and INPRO are not redundant — they address different time horizons and governance levels in ways that are mutually reinforcing.

The proposed framework positions sustainability governance at the centre of strategic project management, enabling sustainability considerations to shape organisational governance, decision-making, stakeholder engagement, performance measurement and long-term project planning from the earliest stages of project development.

3.1 Sustainability governance as a strategic management framework

Within the JEK2 project, sustainability governance was developed as an integrated management framework supporting responsible project planning and long-term value creation. This goes beyond compliance: sustainability considerations are incorporated into governance structures, management processes and project oversight from the outset.

This is especially important for nuclear projects because planning decisions made during early development determine environmental, economic and social outcomes over decades. Getting sustainability governance right at this stage improves decision quality long before operational activities begin.

3.2 From corporate strategy to project governance: the governance cascade

A critical challenge in large infrastructure projects is ensuring that corporate sustainability commitments translate into operational project decisions. Within the JEK2 framework, this is addressed through a structured cascade from GEN energija's corporate ESG strategy through CSRD and ESRS requirements and double materiality assessment, down to project-level risk management, KPI monitoring and investment decision-making.

Rather than treating corporate sustainability strategy and project governance as parallel systems that occasionally intersect, this cascade ensures sustainability is embedded into each phase of project planning and execution. The corporate level sets the ESG objectives and reporting obligations; the project level operationalises them through concrete governance mechanisms — risk registers, performance indicators and structured decision-making processes. This top-down alignment, combined with bottom-up reporting of project-level sustainability data, creates a closed feedback loop between organisational strategy and project reality.

3.3 Double materiality as the foundation of sustainability governance

One of the fundamental elements of the INSGF is the application of the double materiality principle introduced by ESRS. While traditional governance models often focus primarily on organisational performance and regulatory compliance, double materiality broadens decision-making by requiring simultaneous consideration of two perspectives: the financial effects of sustainability issues on the organisation, and the organisation's effects on society, the environment and the economy.

For a project of JEK2's scale, this matters in practical terms. Decisions taken during early planning influence not only project costs, schedules and technical performance but also long-term environmental protection, stakeholder trust, regional development, workforce capabilities and energy security. Within the proposed governance framework, double materiality functions as a strategic decision-support mechanism — a structured way of identifying sustainability-related impacts, risks and opportunities before major investment decisions are committed.

3.4 ESG strategy as the foundation of governance

Rather than defining sustainability as an independent organisational function, the governance model positions ESG principles as strategic drivers throughout the project lifecycle. The ESG strategy establishes common sustainability objectives for governance, environmental stewardship, stakeholder engagement and organisational development — providing the basis for identifying material sustainability topics and determining how they influence strategic project decisions.

3.5 Sustainability metrics and risk management: BowTie as a governance bridge

One of the principal findings of this study is that sustainability metrics should primarily support management, not reporting. Traditional sustainability reporting concentrates on retrospective disclosure of performance indicators. The JEK2 framework treats sustainability metrics differently — as decision-support instruments used throughout project development.

Within this framework, sustainability indicators contribute to evaluating strategic alternatives, identifying material sustainability issues, supporting project governance, improving organisational transparency and strengthening stakeholder confidence. Sustainability metrics become part of governance rather than elements of an annual report.

Risk management within the JEK2 governance framework is structured around the BowTie methodology, which maps causal relationships between threat sources, critical events and their consequences. This approach enables project management to distinguish between preventive controls — reducing the likelihood of an adverse event — and mitigating controls — limiting its consequences once an event occurs. For a project of JEK2's complexity and duration, BowTie analysis provides a structured basis for connecting sustainability-related risks to operational decision-making, bridging the gap between high-level ESG objectives and day-to-day project governance. The output of BowTie analysis feeds directly into operational plans and project KPIs, creating a traceable link between risk identification and management action.

3.6 Integrating ESRS, IAEA and INPRO principles

The central outcome of this research is an integrated sustainability governance framework combining three internationally recognised approaches.

ESRS provides the sustainability reporting architecture: governance requirements based on double materiality assessment, stakeholder engagement and transparent disclosure of sustainability impacts, risks and opportunities.

IAEA governance principles address leadership, management systems, safety culture, organisational learning and continuous improvement throughout the lifecycle of nuclear facilities. Unlike ESRS, which focuses primarily on reporting, IAEA guidance is concerned with how organisations are governed and managed — making it a natural complement.

INPRO extends sustainability assessment beyond organisational governance by evaluating the long-term sustainability of nuclear energy systems. Across its six dimensions — economics, infrastructure, environment, nuclear safety, waste management, and proliferation resistance — INPRO maps directly onto the ESRS reporting structure, with each INPRO domain corresponding to specific ESRS topic standards. This structural compatibility means the two frameworks reinforce rather than duplicate each other.

Their integration enables sustainability governance to function simultaneously as a reporting framework, a management framework and a strategic planning framework — covering daily project decisions, annual reporting cycles and multi-decade sustainability horizons within a single coherent model.

3.7 Responsible decision-making through sustainability metrics

The proposed governance approach links measurable sustainability indicators to governance performance, environmental protection, stakeholder engagement and organisational resilience. These indicators provide management with objective information that supports decision-making throughout the project lifecycle.

Sustainability reporting becomes a continuous governance process rather than an annual exercise — strengthening accountability and enabling evidence-based management at each stage of the project.

Table 1: Relationship between ESRS, IAEA, INPRO and Sustainable Development Goals within the INSGF.

6

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Framework	Primary contribution	Related SDGs
ESRS	Sustainability governance, transparency, double materiality	SDG 12, SDG 16
IAEA	Leadership, governance, management systems, safety culture	SDG 9, SDG 16
INPRO	Long-term sustainability assessment	SDG 7, SDG 9, SDG 13
INSGF	Integrated strategic governance	SDG 7, SDG 9, SDG 12, SDG 13, SDG 16

4 Discussion

For project management practice, the framework provides a structured methodology for embedding sustainability into strategic decision-making from the earliest project phases. Rather than considering sustainability after key decisions have already been taken, the framework positions it alongside technical, financial and regulatory considerations throughout project planning. This supports better identification of material sustainability issues, improves transparency and strengthens stakeholder confidence.

Unlike conventional sustainability reporting frameworks, which primarily address disclosure obligations, the proposed INSGF integrates governance, strategic planning and long-term sustainability assessment into a single management framework that supports decision-making throughout the project lifecycle. The governance cascade from corporate ESG strategy to project-level risk

management, KPIs and investment decisions ensures that sustainability commitments do not remain abstract — they become operational.

From a societal perspective, transparent sustainability governance can strengthen public trust in major energy infrastructure projects. Nuclear energy projects are developed within complex social environments where stakeholder confidence plays an essential role. Demonstrating that sustainability considerations are embedded into governance processes contributes to more transparent and more informed dialogue with stakeholders — which for a project of JEK2's national significance is not a peripheral concern but a central governance requirement.

Several limitations should be acknowledged. The framework has been developed using a single case study and reflects the organisational context of the JEK2 project within GEN energija. Although the governance principles are expected to be transferable, further validation through other nuclear projects would strengthen their general applicability. The framework has also been developed during the project preparation phase; future research should evaluate its application during construction, commissioning and operation, where additional governance challenges will emerge.

5 Conclusions

The originality of the proposed framework lies in combining European sustainability reporting requirements with internationally recognised nuclear governance principles within a single conceptual governance model. Rather than addressing sustainability reporting and nuclear governance as separate disciplines, the INSGF demonstrates how these approaches reinforce one another and contribute to more comprehensive project governance.

The governance cascade from corporate ESG strategy through ESRS requirements and double materiality assessment to project-level risk management and decision-making addresses one of the most persistent practical challenges in large infrastructure projects: ensuring that sustainability commitments translate into operational reality. The integration of BowTie risk methodology into this cascade provides a concrete mechanism for connecting sustainability objectives to day-to-day project governance decisions.

Although developed within the context of the JEK2 project, the framework has potential applicability beyond a single organisation. It may serve as a reference model for other nuclear programmes and, more broadly, for complex infrastructure projects operating within highly regulated environments where sustainability, governance and long-term value creation are closely interconnected.

Future research should focus on validating the framework through practical implementation, developing measurable governance indicators and exploring the integration of digital decision-support tools, artificial intelligence and advanced sustainability analytics into project governance. Such developments could further strengthen sustainability management and improve evidence-based decision-making throughout the lifecycle of large infrastructure investments.

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